**Description.** Suppose you are travelling from town $A$ to town $B$ with a mobile communication device. To ensure you never lose connection, you decide to travel only in regions that are within the transmission range of at least two base stations (each base station has a circular transmission range). The question is: How much of a detour do you have to accept compared to a direct route between $A$ and $B$?

More formally, the problem can be stated as follows: Given a covering of the plane with (closed) unit disks, we define $\Omega$ as the region given by all points that are covered by at least two disks (the grey-colored region in the figure below). Given two points $A, B \in \Omega$, we let $d(A, B)$ denote the (direct) distance between $A$ and $B$, and $d_\Omega(A, B)$ the length of a shortest path between $A$ and $B$ that uses only points from $\Omega$. It was conjectured that for any choice of $A$ and $B$ we have

$$d_\Omega(A, B) \leq \sqrt{2} \cdot d(A, B) + c,$$

where $c$ is a small constant [1].

**Goal.** The goal of this thesis is to tackle this conjecture by implementing a given proof strategy (this should at least allow us to prove a constant which is reasonably close to $\sqrt{2}$, which would already be progress, cf. [2]).

**Prerequisites.** Good geometric intuition, willingness and endurance to translate intuition into formal proofs.

**References.**


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